

REMARKS

Reconsideration and allowance of the subject application are respectfully requested. Upon entry of this Amendment, claims 1-38 are pending in the application. In response to the Office Action, Applicant respectfully submits that the pending claims define patentable subject matter.

Claims 3, 4, 6, 8-19, 22, 23, 25 and 27-38 are objected to as being dependent upon a rejected base claim but would be allowable if rewritten in independent form. By this Amendment, Applicant has rewritten claims 3 and 22 in independent form. Accordingly, Applicant respectfully submits that claims 2, 4, 6, 8-19, 22, 23, 25 and 27-38 should now be in condition for allowance.

I. Preliminary Matters

The Examiner did not acknowledge the claim for priority under 35 U.S.C. § 119(e) based on U.S. Provisional Application No. 60/221,553. Applicant requests the Examiner acknowledge the claim for priority under § 119(e) in the next action.

Further, the Examiner did not acknowledge the claim for foreign priority under 35 U.S.C. § 119 based on Korean Application No. 00-56150.¹ Accordingly, the Examiner is requested to acknowledge the claim for foreign priority under 35 U.S.C. § 119 in the next action.

¹ Applicant is obtaining a certified copy of Korean Application No. 00-56150 and will submit it to the USPTO in the near future.

The drawings are objected to because the Examiner maintains that in Fig. 5, point “a” at location (4,-4) should be changed to point “b” and point “a” at location (-4,4) should be changed to “c”. Along with this amendment, Applicant is submitting drawing replacement sheets wherein Fig. 5 is amended to address the concerns raised by the Examiner. In addition, Fig. 2B has been amended to change “FORMAN” to “FOREMAN” and Fig. 2C has been amended to change “DOUGHTER” to “DAUGHTER”. Accordingly, the Examiner is requested to remove the objection to drawings.

II. Prior Art Rejection

Claims 1, 2, 5, 7, 20, 21, 24 and 26 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Park et al. (U.S. Patent No. 6,584,212; hereafter “Park”) in view of Lim et al. (U.S. Patent No. 6,332,002; hereafter “Lim”). Applicant respectfully traverses the prior art rejection.

A. Disclosure of Park

In support of the rejection, the Examiner cites columns 1 and 2 of Park which describe a conventional four-step search (4SS) algorithm. As shown in Figs. 1 and 2 of Park, the 4SS algorithm performs a first step of finding a minimum block distance measure (BDM) point by searching nine locations in a search block of 5 x 5 size located at the center of a search window of 15 x 15 size. The minimum BDM point is determined by calculating a sum of absolute difference value (SAD) for each search location and selecting the search point with the minimum

SAD value as the minimum BDM point. If the minimum BDM point is found at the center of the search block, the algorithm goes to a fourth step. If the minimum BDM point is not found at the center of the search block, the algorithm goes to a second step.

In the second step, a search method depends on the location of the minimum BDM point while the size of the search block maintains a 5 x 5 size. At first, if the minimum BDM point locates an edge of the search block, the second step searches five additional locations. And if the minimum BDM point locates the middle of a horizontal axis and a vertical point, the second step searches three additional locations. Then, if the minimum BDM point is found at the center of the search block, the second step goes to the fourth step. Otherwise, if the minimum BDM point is not found at the center of the search block, the second step goes to a third step.

A third step is performed similar to the second step, that is, the third step goes to the fourth step, if the minimum BDM point locates the center of a search block. At the fourth step, the size of the search block decrease 3 x 3. The smallest BDM point of nine locations is considered as a final motion vector (MV). If the minimum BDM point is found at the center of the search block, the intermediate steps of the 4SS algorithm may be omitted or a step may directly go to the last step having the search block of 3 x 3 size.

B. Disclosure of Lim

Lim discloses a motion prediction method and apparatus employing a hierarchical block matching algorithm for single-pixel estimation and half-pixel estimation. In the method and apparatus, a motion in a single pixel unit is repeatedly retrieved in accordance with a position

information detected dependently at a plurality of layers with respect to an input image, and the input image is coded and decoded. Then, a motion in a single and half pixel unit for a decoded reconstructed image is estimated at a certain layer in the plurality of layers.

The block matching algorithm for half-pixel estimation utilizes the mean absolute difference (MAD) as a criterion for finding the most analogous block to a specified block of an input image at the local area of the previous image. A MAD between a certain block B_{t-1} and a specified block B_t having a size of $N_B \times N_B$ is calculated at every certain position (u,v) in the local area of the previous image I_{t-1} . A position $((u,v)^*)$ of a block B_{t-1} having the smallest MAD in the previous image I_{t-1} is utilized to determine a motion vector MV in a half pixel unit.

C. Analysis

Independent claim 1 is directed to a motion estimation method. Independent claim 20 is directed to software contained in a computer readable medium comprising instructions to instruct a processor to perform a routine. Claims 1 and 20 recite:

- (a) calculating respective mean difference values for a current search point of a search block and neighboring search points within the search block;
- (b) performing motion estimation around the current search point if the mean difference value of the current search point is smaller than the mean difference values of the neighboring search points; and
- (c) performing motion estimation based on the mean difference values of at least some of the neighboring search points if the mean difference value of the current search point is not smaller than the mean difference values of at least one the neighboring search points.

With regard claims 1 and 20, the Examiner asserts that Park discloses all of the features of the claimed invention except using Mean Absolute Difference (MAD) values as claimed. That is, the Examiner contends that the difference between Park and the claimed invention is that Park discloses using Sum of Absolute Difference (SAD) values rather than MAD values. In view of conceded deficiencies of Park, the Examiner cites Lim for allegedly disclosing the use of MAD values to determine the difference between a search point in a current frame and a corresponding point in a subsequent frame. Further, the Examiner asserts that "it would have been obvious ... to substitute MAD values, as explained by Lim et al, for the SAD values used in the system of Park et al as both values are used to predict motion between two frames and the MAD is not as susceptible to noise, thereby providing a more accurate difference value."

Applicant respectfully submits that one of ordinary skill in the art would not have been motivated to modify Park based on the teachings of Lim to produce the claimed invention.

To establish a *prima facie* case of obviousness under 35 U.S.C. § 103, (1) there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify and/or combine the reference teachings, (2) there must be a reasonable expectation of success, and (3) the references must teach or suggest all the claim limitations. The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art suggests the desirability of the combination. *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990).

In the present case, Applicant respectfully submits that Lim does not provide the requisite motivation for modifying the 4SS algorithm disclosed by Park. In particular, nowhere does Lim

teach that MAD values may successfully be used in place of SAD values in the 4SS algorithm as alleged by the Examiner. Although cited references individually teach that SAD values and MAD values may be used to predict motion between two frames, the 4SS algorithm disclosed by Park utilizes SAD values in a different manner than the half pixel block matching algorithm of Lim utilizes MAD values. Further, the Examiner's assertion that one of ordinary skill in the art would use MAD values in place of SAD values because "the MAD is not as susceptible to noise, thereby providing a more accurate difference value" is not taught or suggested by Lim.

It is incumbent upon the Examiner to establish a factual basis to support the legal conclusion of obviousness. *In re Fine*, 837 F.2d 1071, 5 U.S.P.Q.2d 1596 (Fed. Cir. 1988). This burden can only be satisfied by an objective teaching in the prior art or by cogent reasoning that the knowledge is available to one of ordinary skill in the art. See *In re Lahu*, (747 F.2d 703, 223 U.S.P.Q. 1257 (Fed. Cir. 1984)). However, the Examiner does not point out any portion of the cited references which suggest the desirability of modifying the teachings of Park.

Accordingly, Applicant respectfully submits that independent claims 1 and 20, as well as dependent claims 2, 5, 7, 21, 24 and 26, would not have been rendered obvious in view of Park and Lim because one of ordinary skill in the art would not have been motivated to combine and modify the applied references to produce the claimed invention.

III. Conclusion

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the

AMENDMENT UNDER 37 C.F.R. § 1.111
U.S. Patent Application No. 09/783,330

Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,



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